

Week 2

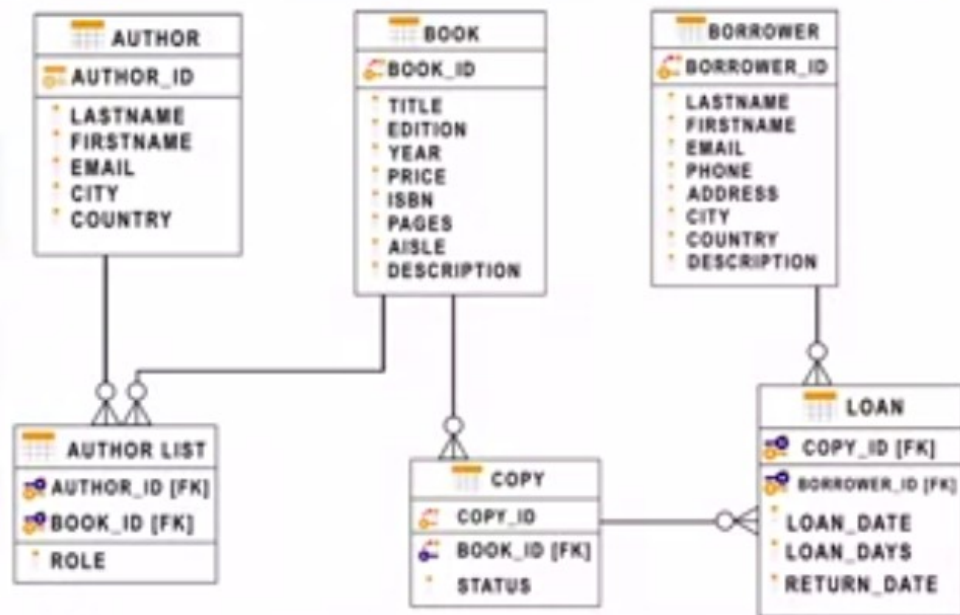
# Relational Database Concepts

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# Relational Model

- Most used data model
- Allows for data independence
- Data is stored in a tables








logical data independence - physical data independence - physical storage independence

# Entity-Relationship Model

- Used as a tool to design relational databases



|                                                                                      |             |
|--------------------------------------------------------------------------------------|-------------|
|   | BOOK        |
|   | BOOK_ID     |
|   | TITLE       |
|   | EDITION     |
|   | YEAR        |
|   | PRICE       |
|   | ISBN        |
|   | PAGES       |
|   | AISLE       |
|  | DESCRIPTION |

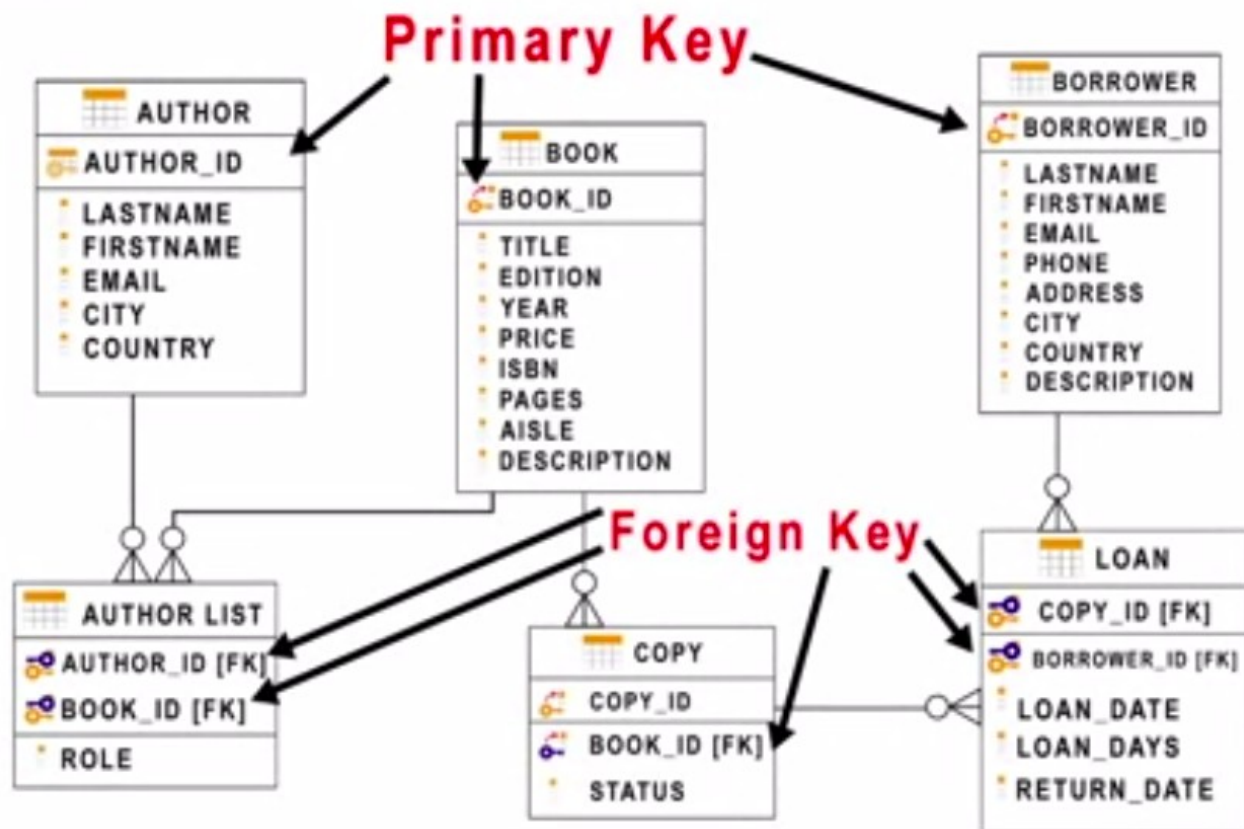
# Mapping Entity Diagrams to Tables

- Entities become tables
- Attributes get translated into columns

Table: Book

| Title                              | Edition | Year | Price | ISBN              | Pages | Aisle  | Description                                                                    |
|------------------------------------|---------|------|-------|-------------------|-------|--------|--------------------------------------------------------------------------------|
| Database Fundamentals              | 1       | 2010 | 24.99 | 978-0-9866283-1-1 | 300   | DB-A02 | Teaches you the fundamentals of databases                                      |
| Getting started with DB2 Express-C | 1       | 2010 | 24.99 | 978-0-9866283-5-1 | 280   | DB-A01 | Teaches you the essentials of DB2 using DB2 Express-C, the free version of DB2 |

# Primary Keys and Foreign Keys





# Summary

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Now you know:

- The key advantage of the relational model is data independence
- Entities are independent objects which have Attributes
- Entities map to Tables in a Relational Database
- Attributes map to Columns in a Table
- Common data types include characters, numbers, and dates/times
- A Primary Key uniquely identifies a specific row in a table

# How to create a Database instance on cloud

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# In this video...

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- Cloud Database Basics
- List some Cloud Databases
- Describe a Database Instance
- Create an instance of IBM Db2 on Cloud

# Cloud databases

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- ✓ Ease of Use and Access
  - API
  - Web Interface
  - Cloud or Remote Applications
- ✓ Scalability & Economics
  - Expand/Shrink Storage & Compute Resources
  - Pay per use
- ✓ Disaster Recovery
  - Cloud Backups and Geographical Distribution



# Examples of Cloud databases

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- IBM Db2
- Databases for PostgreSQL
- Oracle Database Cloud Service
- Microsoft Azure SQL Database
- Amazon Relational Database Services (RDS)

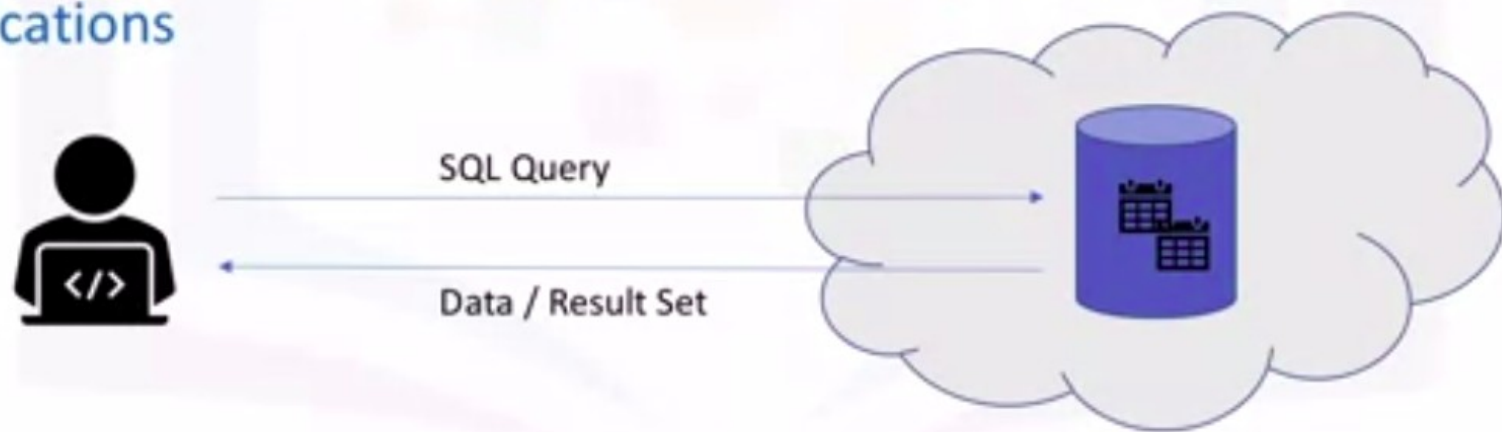
Available as:

- VMs or Managed Service
- Single or Multi-tenant



# Database service instances

- DBaaS provides users with access to Database resources in cloud without setting up hardware and installing software.
- Database service instance holds data in data objects / tables
- Once data is loaded, it can be queried using web interfaces and applications



# Creating a database instance on IBM Db2 on Cloud

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IBM Db2 on Cloud



## Question

What are the advantages of using cloud databases

- ☐ Ease of Use and Management
- ☐ Scalability
- ☐ Disaster Recovery
- ☒ All of the above



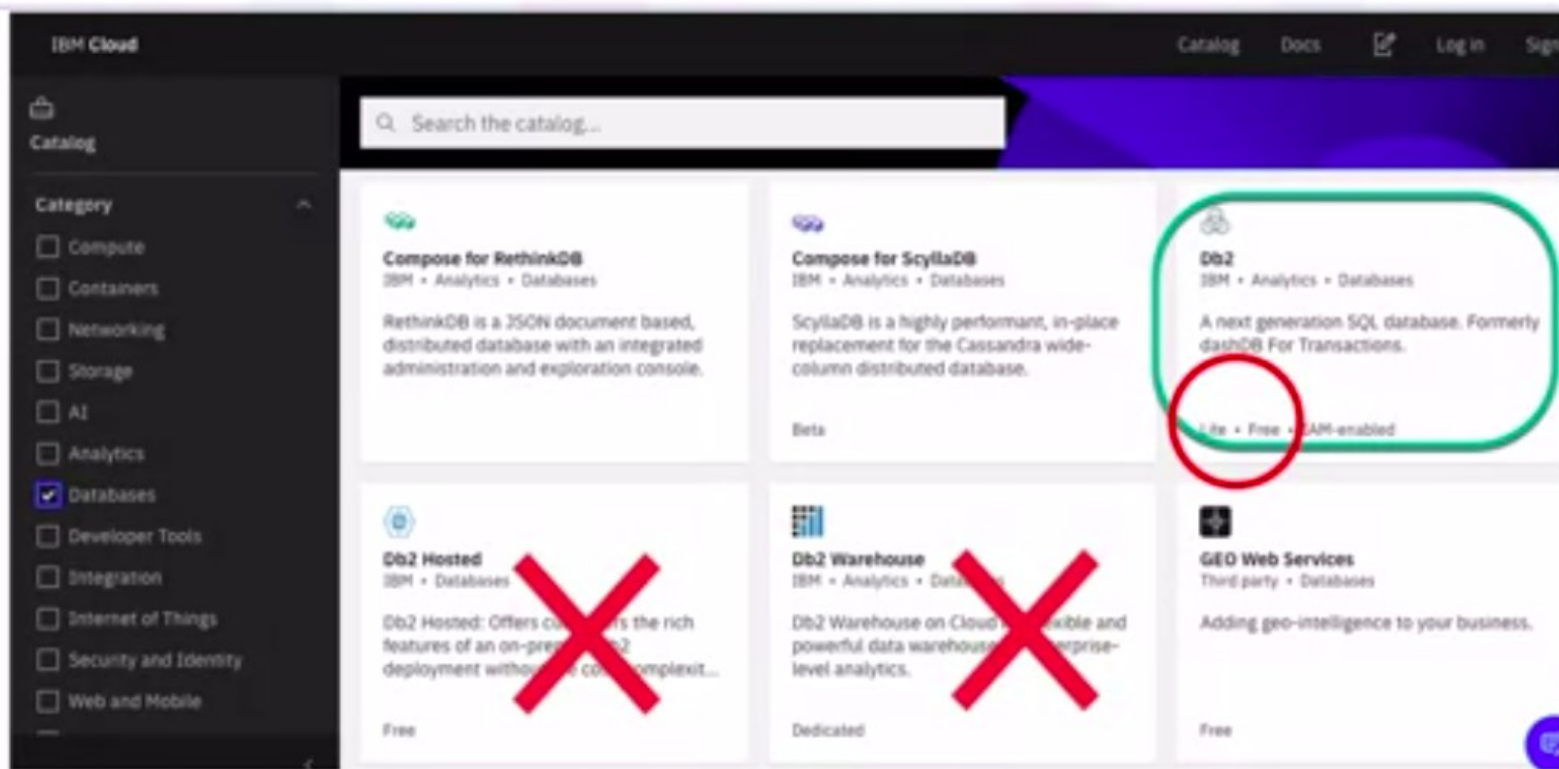
**Correct**

Correct! All of the above are advantages of using cloud databases. Cost and paying for only the resources you utilize may be another advantage.

[Skip](#)

[Continue](#)

# Deploy an instance of Db2 on Cloud Service





# Create a new service

IBM Cloud Search resources and offerings Catalog Docs Support Manage

## Db2

Author: IBM • Date of last update: 04/29/2020 • Docs • API docs

Create About

Select a region

Select a region

Dallas

Select a pricing plan

Displayed prices do not include tax. Monthly prices shown are for country or region: [United States](#)

| Plan | Features                                                                           | Pricing |
|------|------------------------------------------------------------------------------------|---------|
| Free | 200 MB of data storage<br>5 simultaneous connections<br>Shared multi-tenant system | Free    |

The Free plan provides a free Db2 service for development and evaluation. The plan has a set amount of limitations as shown. You can continue using the free plan for as long as needed, however, users are asked to re-extend their free account every 90 days by email. If you do not re-extend, your free account is cleaned out a further 90 days later. This helps provide free resources for everyone.

Free plan services are deleted after 30 days of inactivity.

Create

Add to estimate

Summary

Db2 Free

Region: Dallas

Plan: Free

Service name: Db2-12

# View the newly created service

Dashboard

Resource summary [View all](#)



4  
Resources

**Services**

Storage

3  
1

^ **Services (3)**

|                                                                                                              |         |
|--------------------------------------------------------------------------------------------------------------|---------|
| Db2-tq-01                                                                                                    | Default |
|  Watson Studio-8w           | Default |
|  watson-vision-combined-ey | Default |

# Manage the database instance

Resource list /

Db2-tq-01 Active [Add tags](#) [🔗](#)

[Details](#) [Actions...](#)

Getting started

**Manage**

[Service credentials](#)

[Plan](#)

[Connections](#)

[Open Console](#)

**Getting Started**

**Where can I find my credentials?**  
Get your username and password by clicking the "Service Credentials" link to the left and selecting "New Credentials".

[Getting Started](#)

**Need Help?**

Use IBM dW Answers to view recently asked questions or ask your own. Still unable to find an answer? Submit a Bluemix Support Ticket to our team.

[IBM dW Answers](#) [Support Ticket](#)

# Create new service credentials


Resource list / Db2-tq-01 Active [Add tags](#) [⌵](#) Details Actions...

Getting started  
Manage  
**Service credentials**  
Plan  
Connections

## Service credentials

You can generate a new set of credentials for cases where you want to manually connect an app or external consumer to an IBM Cloud™ service. [Learn more](#)

New credential +

| Key name                                                                                                                                                                                                                                                                               | Date created |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|  <p>No service credentials</p> <p>Credentials are provided in JSON format. The JSON snippet lists credentials, such as the API key and secret, as well as connection information for the service.</p> |              |

# Service credentials

Resource tool / Db2-tq-01 Active [Add tags](#) [Details](#) [Actions...](#)

Getting started  
Manage  
**Service credentials**  
Plan  
Connections

You can generate a new set of credentials for cases where you want to manually connect an app or external consumer to an IBM Cloud™ service.  
[Learn more](#)

[New credential](#)

| Key name              | Date created              |
|-----------------------|---------------------------|
| Service credentials-1 | MAY 4, 2020 - 04:29:29 PM |

```
{
  "db": "BLUDB",
  "dsn": "DATABASE=BLUDB;HOSTNAME=dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net;PORT=50000;PROTOCOL=TCP;UID=lc112330;PWD=zgrvzlmhrcvpgg",
  "host": "dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net",
  "hostname": "dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net",
  "https_url": "https://dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net",
  "jdbcurl": "jdbc:db2://dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net:50000/BLUDB",
  "parameters": {},
  "password": "zgrvzlmhrcvpgg",
  "port": 50000,
  "sqldsn": "DATABASE=BLUDB;HOSTNAME=dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net;PORT=50000;PROTOCOL=TCP;UID=lc112330;PWD=zgrvzlmhrcvpgg;Security=SSL",
  "sqljdbcurl": "jdbc:db2://dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net:50000/BLUDB:sqlConnection=true;",
  "uri": "db2://lc112330:zgrvzlmhrcvpgg@dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net:50000/BLUDB",
  "username": "lc112330"
}
```

# Service credentials

|                                                                                  | Key name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Date created              |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|  | Service credentials-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MAY 4, 2020 - 04:29:29 PM |
|                                                                                  | <pre>{   "db": "BLUD8",   "dsn": "DATABASE=BLUD8;HOSTNAME=dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com;PORT=50000;PROTOCOL=TCPIP;UID=lct12330;PWD=zgxr1m1mbzv+pgg:",   "host": "dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com",   "hostname": "dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com",   "https_url": "https://dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com",   "jdbcurl": "jdbc:db2://dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com:50000/BLUD8",   "parameters": {},   "password": "zgxr1m1mbzv+pgg",   "port": 50000,   "ssldsn": "DATABASE=BLUD8;HOSTNAME=dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com;PORT=50001;PROTOCOL=TCPIP;UID=lct12330;PWD=zgxr1m1mbzv+pgg;Security=SSL:",   "ssljdbcurl": "jdbc:db2://dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com:50001/BLUD8:sslConnection=true",   "uri": "db2://lct12330:zgxr1m1mbzv+pgg@dashdb-txn-sbox-yp-dal09-04.services.dal.ibm.com:50000/BLUD8",   "username": "lct12330" }</pre> |                           |

# Types of SQL statements

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DDL vs. DML

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# Objectives

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At the end of this video, you will be able to:

- Distinguish between Data Definition Language statements and Data Manipulation Language statements

# Types of SQL Statements - DDL

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- SQL Statement types: DDL and DML
- DDL (Data Definition Language) statements:
  - Define, change, or drop data
- Common DDL:
  - CREATE
  - ALTER
  - TRUNCATE
  - DROP

# Types of SQL Statements - DML

---

- DML (Data Manipulation Language) statements:
  - Read and modify data
  - CRUD operations (Create, Read, Uppdate & Delele rows)
- Common DML:
  - INSERT
  - SELECT
  - UPDATE
  - DELETE

# Summary

---

Now you know that:

- DDL used for defining objects (tables)
- DML used for manipulating data in tables

# CREATE TABLE Statement

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# Objectives

---

At the end of this video, you will be able to:

- Create a Table in a relational database using Entity Name, Attributes and the CREATE TABLE statement

# CREATE table

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- **Syntax:**

```
CREATE TABLE table_name
(
    column_name_1 datatype optional_parameters,
    column_name_2 datatype,
    ...
    column_name_n datatype
)
```



# EXAMPLE

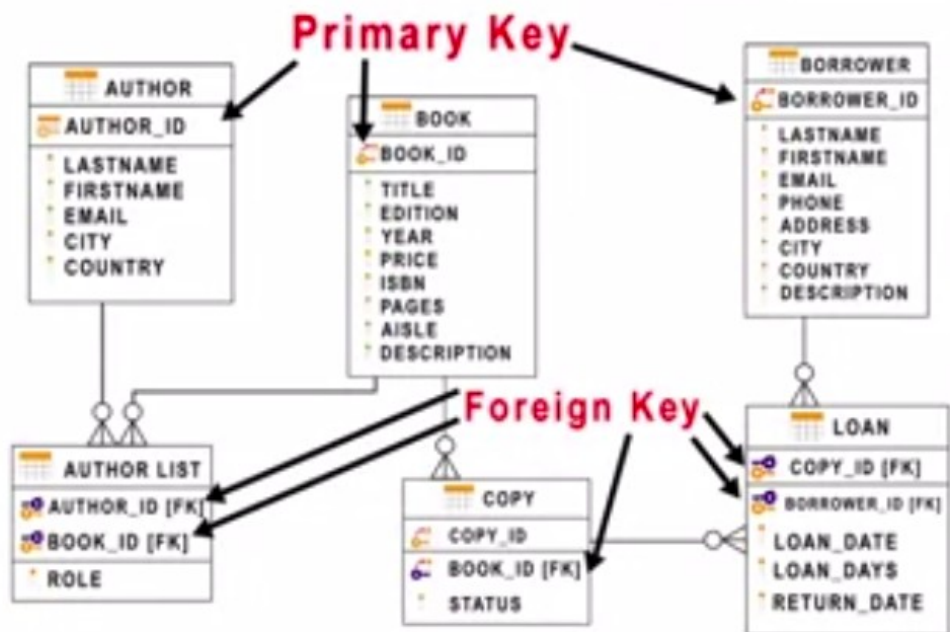
---

- Create a table for Canadian provinces

```
CREATE TABLE provinces(  
    id char(2) PRIMARY KEY NOT NULL,  
    name varchar(24)  
)
```

| id<br>char(2) | name<br>varchar(24) |
|---------------|---------------------|
| AB            | ALBERTA             |
| BC            | BRITISH COLUMBIA    |
| ...           | ...                 |

# Create a table



**Primary Key: Uniquely Identifies each Row in a Table**

# CREATE TABLE Statement

---

To create the Author table, use the following columns and datatypes:

AUTHOR(Author\_ID:char, Lastname:varchar, Firstname:varchar, Email:varchar, City:varchar, Country:char)

```
CREATE TABLE author (  
  author_id CHAR(2) PRIMARY KEY NOT NULL,  
  lastname VARCHAR(15) NOT NULL,  
  firstname VARCHAR(15) NOT NULL,  
  email VARCHAR(40),  
  city VARCHAR(15),  
  country CHAR(2)  
)
```

# CREATE TABLE Statement

---

To create the Author table, use the following columns and datatypes:

AUTHOR(Author\_ID:char, Lastname:varchar, Firstname:varchar, Email:varchar, City:varchar, Country:char)

```
CREATE TABLE author (  
    author_id CHAR(2) PRIMARY KEY NOT NULL,  
    lastname VARCHAR(15) NOT NULL,  
    firstname VARCHAR(15) NOT NULL,  
    email VARCHAR(40),  
    city VARCHAR(15),  
    country CHAR(2)  
)
```

# Summary

---

Now you know that:

- CREATE used for creating entities (tables) in a relational database
- CREATE TABLE statement includes definition of attributes (columns):
  - Names of columns
  - Datatypes of columns
  - Constraints (e.g. Primary Key)

# ALTER, DROP, and TRUNCATE Tables

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# Objectives

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After watching this video, you will be able to:

- Describe the ALTER TABLE, DROP TABLE, and TRUNCATE statements
- Explain the syntax
- Use the statement in queries



## ALTER TABLE ... ADD COLUMN

---

- Add or remove columns
- Modify the data type of columns
- Add or remove keys
- Add or remove constraints

```
ALTER TABLE <table_name>  
    ADD COLUMN <column_name_1> datatype  
    . . .  
    ADD COLUMN <column_name_n> datatype;
```

## ALTER TABLE ... ADD COLUMN

```
ALTER TABLE author  
ADD COLUMN telephone_number BIGINT;
```

| author_id | lastname | firstname | email       | city     | country | telephone_number |
|-----------|----------|-----------|-------------|----------|---------|------------------|
| 1001      | Thomas   | John      | johnt@...   | New York | USA     | 5551111          |
| 1002      | James    | Alice     | alicej@...  | Seattle  | USA     | 5551112          |
| 1003      | Wells    | Steve     | stevew:@... | Montreal | Canada  | 5552222          |
| 1004      | Kumar    | Santosh   | kumars@...  | London   | UK      | 5553333          |

## ALTER TABLE ... ALTER COLUMN

```
ALTER TABLE author
```

```
    ALTER COLUMN telephone_number SET DATA TYPE  
    CHAR(20);
```

| author_id | lastname | firstname | email      | city     | country | telephone_number |
|-----------|----------|-----------|------------|----------|---------|------------------|
| 1001      | Thomas   | John      | johnt@...  | New York | USA     | 555-1111         |
| 1002      | James    | Alice     | alicej@... | Seattle  | USA     | 555-1112         |
| 1003      | Wells    | Steve     | stevew@... | Montreal | Canada  | 555-2222         |
| 1004      | Kumar    | Santosh   | kumars@... | London   | UK      | 555-3333         |

## ALTER TABLE ... DROP COLUMN

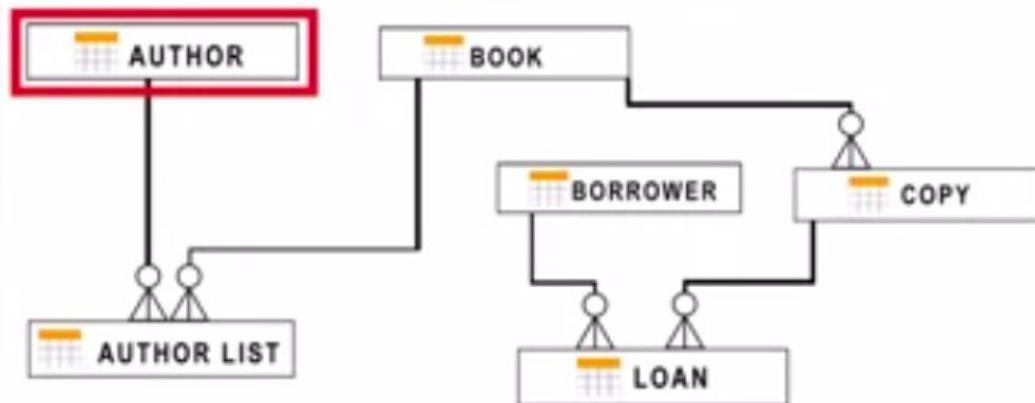
```
ALTER TABLE author  
DROP COLUMN telephone_number;
```

| author_id | lastname | firstname | email       | city     | country |
|-----------|----------|-----------|-------------|----------|---------|
| 1001      | Thomas   | John      | johnt@...   | New York | USA     |
| 1002      | James    | Alice     | alicej@...  | Seattle  | USA     |
| 1003      | Wells    | Steve     | stevew:@... | Montreal | Canada  |
| 1004      | Kumar    | Santosh   | kumars@...  | London   | UK      |

# DROP TABLE

```
DROP TABLE <table_name>;
```

```
DROP TABLE author;
```





# TRUNCATE TABLE

---

```
TRUNCATE TABLE author
```

```
IMMEDIATE;
```

| author_id | lastname | firstname | email | city | country |
|-----------|----------|-----------|-------|------|---------|
|           |          |           |       |      |         |
|           |          |           |       |      |         |
|           |          |           |       |      |         |
|           |          |           |       |      |         |

# Summary

---

In this video, you learned that:

- The ALTER TABLE statement changes the structure of an existing table, for example to add, modify, or drop columns
- The DROP TABLE statement deletes an existing table
- The TRUNCATE TABLE statement deletes all rows of data in a table



**Introduction to Relational Databases and Tables**

- ✓ **Video:** Relational Database Concepts  
5 min
- ✓ **Video:** How to create a Database instance on Cloud  
5 min
- 🔗 **Ungraded External Tool:** Obtain IBM Cloud Feature Code and Activate Trial Account  
1h
- ✓ **Ungraded Plugin:** Hands-on Lab: Create Db2 service instance and Get started with the Db2 console  
15 min
- ✓ **Video:** Types of SQL statements (DDL vs. DML)  
2 min
- ✓ **Video:** CREATE TABLE Statement

# Summary & Highlights

Congratulations! You have completed this lesson. At this point in the course, you know:

- A database is a repository of data that provides functionality for adding, modifying, and querying the data.
- SQL is a language used to query or retrieve data from a relational database.
- The Relational Model is the most used data model for databases because it allows for data independence.
- The primary key of a relational table uniquely identifies each tuple or row, preventing duplication of data and providing a way of defining relationships between tables.
- SQL statements fall into two different categories: Data Definition Language (DDL) statements and Data Manipulation Language (DML) statements.

✓ **Completed**

**Go to next item**





## Practice Quiz

Practice Quiz • 15 min • 5 total points

Due Apr 2, 11:59 PM IST

1. What is the function of a primary key?

1 / 1 point

- ☐ The primary key is used to grant access to a table.
- ☒ The primary key uniquely identifies each row in a table.
- ☐ The primary key enables you to add data to columns.
- ☐ The primary key is used to identify any rows in the table that contain NULL values.



Correct

Correct. The primary key uniquely identifies each row in a table.

2. True or False: Data Manipulation Language statements like INSERT, SELECT, UPDATE, and DELETE are used to read and modify data.

1 / 1 point

- ☒ True
- ☐ False



Correct

Correct. Data Manipulation Language statements like INSERT, SELECT, UPDATE, and DELETE are used to read and modify data.



## Practice Quiz

Practice Quiz • 15 min • 5 total points

Due Apr 2, 11:59 PM IST

☐ False



Correct

Correct. Data Manipulation Language statements like INSERT, SELECT, UPDATE, and DELETE are used to read and modify data.

3. Data Definition Language (or DDL) statements are used to define, change, or delete database objects such as tables. Which of the following statements are all DDL statements?

1 / 1 point

☐ SELECT and DELETE

☒ CREATE, ALTER, DROP

☐ INSERT and UPDATE

☐ SELECT, INSERT, UPDATE



Correct

Correct. The CREATE, ALTER, and DROP statements act on objects such as tables, not the data within the table.

4. Which of the following queries will change the data type of an existing column (phone) to the varchar data type?

1 / 1 point

☒ ALTER TABLE author ALTER COLUMN phone SET DATA TYPE VARCHAR(20);



Back

## Practice Quiz

Practice Quiz • 15 min • 5 total points

Due Apr 2, 11:59 PM IST

4. Which of the following queries will change the data type of an existing column (phone) to the varchar data type?

1 / 1 point

- ☒ ALTER TABLE author ALTER COLUMN phone SET DATA TYPE VARCHAR(20);
- ☐ ALTER COLUMN phone SET DATA TYPE VARCHAR(20);
- ☐ ALTER TABLE author ALTER COLUMN phone SET TYPE VARCHAR(20);
- ☐ ALTER TABLE author ALTER COLUMN phone DATA TYPE = VARCHAR(20);



Correct

Correct. This query will change the data type to varchar.

5. The five basic SQL commands are:

1 / 1 point

- ☐ SELECT, COPY, PASTE, INSERT, ALTER
- ☐ None of the above
- ☒ CREATE, SELECT, INSERT, UPDATE, DELETE
- ☐ CREATE, INSERT, RETRIEVE, MODIFY, DELETE



Correct

Correct. The five basic SQL commands are CREATE, SELECT, INSERT, UPDATE, and DELETE.



Back

## Graded Quiz: Relational DB Concepts and Tables

Graded Quiz • 9 min

Due Apr 2, 11:59 PM IST

1. Which of the following statements about a database is/are correct?

1 / 1 point

- ☒ A database is a logically coherent collection of data with some inherent meaning
- ☐ Data can only be added and queried from a database, but not modified.
- ☐ Only SQL can be used to query data in a database.
- ☐ All of the above



Correct

Correct. A database is a repository or logically coherent collection of data with some inherent meaning

2. Attributes of an entity become \_\_\_\_\_ in a table.

1 / 1 point

- ☐ rows
- ☒ columns
- ☐ constraints
- ☐ keys



Correct

Correct. Attributes of an entity become columns in a table.



## Graded Quiz: Relational DB Concepts and Tables

Graded Quiz • 9 min

Due Apr 2, 11:59 PM IST

2. Attributes of an entity become \_\_\_\_\_ in a table.

1 / 1 point

- ☐ rows
- ☒ columns
- ☐ constraints
- ☐ keys



Correct

Correct. Attributes of an entity become columns in a table.

3. The CREATE TABLE statement is a....

1 / 1 point

- ☐ DML statement
- ☒ DDL statement
- ☐ Both of the above



Correct

Correct. The CREATE TABLE statement defines a table, so it is a DDL statement.